WHAT IS CLAIMED IS:

1. A method for magnetic imaging of an object, the method comprising:

monitoring a magnetic field of sources in the object at a plurality of magnetic detectors to obtain a corresponding plurality of sensor outputs;

while monitoring the magnetic field of the sources, monitoring a position of the object;

modeling the magnetic field of the sources in the object as a gradient of a scalar potential, the scalar potential comprising a sum of spherical harmonic functions each multiplied by a corresponding coefficient; and,

compensating for changes in the position of the object by applying a transformation to the plurality of sensor outputs, the transformation including, at least in part, a spherical harmonic translation transformation.

2. A method according to claim 1 wherein the scalar potential comprises at least one additional term in addition to the spherical harmonic functions.

3. A method according to claim 2 wherein the additional term comprises a potential corresponding to point dipole sources.

4. A method according to claim 3 wherein the additional term comprises a potential corresponding to point current dipole source.

5. A method according to claim 3 wherein the additional term has a distance dependance such that the term drops off with distance at least as quickly as the inverse square of the distance.

6. A method according to claim 3 wherein the additional term is of the form: $a' g(\vec{r})$ where $a'$ is a coefficient and $g(\vec{r})$ is a function of a position $\vec{r}$ .

7. A method according to claim 6 wherein $g(\vec{r})$ is given by:

$$\frac{\vec{m} \cdot (\vec{r} - \vec{s})}{|\vec{r} - \vec{s}|^3}$$

where $\vec{s}$ is a fixed position; and $\vec{m}$ is a dipole moment.

8. A method according to claim 1 wherein a number $\boldsymbol{N}$ of the spherical harmonic functions exceeds a number $\boldsymbol{M}$ of the plurality of magnetic detectors.

9. A method according to claim 8 wherein the corresponding coefficients for the spherical harmonic functions are obtained by applying a $\boldsymbol{M} \times \boldsymbol{N}$ forward solution matrix to the plurality of sensor outputs.

10. A method according to claim 9 wherein elements of the forward solution matrix are computed based upon geometry and properties of the plurality of detectors.

11. A method according to claim 1 wherein a number ***N*** of the spherical harmonic functions is less than a number ***M*** of the plurality of magnetic detectors.

12. A method according to claim 11 wherein modeling the magnetic field of the sources comprises performing a fitting process.

13. A method according to claim 12 wherein the fitting process comprises performing a least squares computation.

14. A method according to claim 1 wherein compensating for the position of the object comprises applying a forward solution matrix to the plurality of sensor outputs.

15. A method according to claim 1 wherein compensating for the position of the object comprises applying a regularized backward solution matrix to the plurality of sensor outputs.

16. A method according to claim 15 comprising regularizing the backward solution matrix by performing a Tikhonov regularization.

17. A method according to claim 1 wherein compensating for the position of the object comprises applying a rotation matrix to the plurality of sensor outputs.

18. A method according to claim 1 wherein compensating for the position of the object comprises calculating a vector of corrected sensor outputs $\vec{B}(0,0)$ according to the formula:

$$\vec{B}(0,0)_m \approx \vec{L}(0,0)_{mp}\left[\vec{R}^{(a)}\right]^{-1}_{pq} \vec{T}(-\vec{u})_{qs}\,\vec{Q}(0,0)_{s\nu}\,\vec{B}(R,\vec{u})_{\nu},$$

or a mathematical equivalent thereof, where $\vec{B}$ (***R***,***U***) is a vector of the plurality of sensor outputs for the position of the object which differs from a reference position (0,0) by the rotation ***R*** and the translation ***U***, $\vec{Q}(0,0)$ is a regularized backward solution matrix, $\vec{T}(-\vec{u})$ is a spherical harmonic function translation matrix, $\vec{R}^{(a)}$ is a spherical harmonic function rotation matrix, and $\vec{L}(0,0)$ is a forward solution matrix.

19. A method according to claim 1 wherein the corresponding coefficients for the spherical harmonic functions are selected such that a normalization function is minimized.

20. A method according to claim 19 wherein the energy function comprises an integral of a derivative of the scalar potential over a volume wherein the volume includes the sensors.

21. A method according to claim 20 wherein the volume comprises a spherical shell.

22. A method according to claim 20 wherein magnetic detectors comprise a plurality of magnetometers and the normalization function comprises:

$$E_1 = \int \sum_{\mu} \left( \frac{\partial \Psi}{\partial r_\mu} \right)^2 dV$$

23. A method according to claim 20 wherein the energy function comprises a linear combination of:

$$E_1 = \int \sum_{\mu} \left( \frac{\partial \Psi}{\partial r_\mu} \right)^2 dV$$

and

$$E_2 = \int \sum_{\mu \nu} \left( \frac{\partial^2 \Psi}{\partial r_\mu \partial r_\nu} \right)^2 dV$$

24. A method according to claim 19 wherein the plurality of magnetic detectors comprise a plurality of first order gradiometers and wherein the energy function comprises: $E_2 = \int \sum_{\mu \nu} \left| \frac{\partial^2 \Psi}{\partial r_\mu \partial r_\nu} \right|^2 dV$,

where $\Psi$ is the scalar potential.